Resuscitation knowledge and skills of University Hospital AHEPA nursing staff

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ABSTRACT

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The aim of this study was to evaluate resuscitation skills and knowledge of the nursing staff of University Hospital "AHEPA", who have previously successfully participated in a validated training CPR/AED course, held in our hospital. In our study 60 professionally active nurses were involved. After completion of a predesigned questionnaire, they were expected to respond to a simulated cardiac arrest-CA scenario in an area where automated external defibrillation-AED was available. The questionnaire consisted of several questions regarding demographic data, participant's personal opinion on the resuscitation training program, CPR performance and nurse's attitudes when facing a CA. Participants were evaluated according to the European Resuscitation Council assessment form for basic life support-BLS with the use of AED (consisting of performance in 17 skills). The vast majority of the study population were female nurses (86.7% and 83.3% respectively), 41-50 years old (70%) with more than 21 years working experience (53.3%). All of them have participated in a validated CPR/AED course held in our hospital and 58.3% more than once. All of them stated that they would be willing to initiate CPR efforts, although half of them (56.7%) have never actually performed CPR. 58.3% of the study participants think that they still retain resuscitation skills and knowledge and all of them believe that the resuscitation training program was effective. CPR performance and AED use in the simulated scenarios were evaluated as adequate in 55-85% and 65-98% respectively. In general, the overall success rate in skills related to AED use,

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were better compared to CPR skills.

CPR/AED skills are not performed very often in daily clinical practice and therefore these resuscitation skills degrade to a significant extend after training. According to our study results, AED skills retention seems to be better compared to CPR skills retention.

INTRODUCTION

Cardiac arrest (CA) is the leading cause of sudden cardiac death. It is responsible for 60% of deaths associated with ischemic heart disease and in 40% of the cases; CA is the first symptom[1-8]. CA is the cessation of the pumping function of the heart, which is confirmed by lack of response and absence of carotid pulse and normal breathing[9-12].

Cardiopulmonary Resuscitation (CPR) is the only treatment option in CA and involves chest compressions, airway opening maneuvers and artificial ventilation[13,14]. Basic Life Support has been replaced by the term CPR with the use of Automated External Defibrillation (CPR/AED), which refers to CA recognition/confirmation and performance of CPR without any kind of equipment besides AED[15]. CA outcome depends mainly on immediate recognition of CA, immediate initiation of chest compressions, early defibrillation and post resuscitation care[11,16,17]. Despite the great medical advances since CPR was formally endorsed in the 1960s, CA outcome remains low (5-10%), because most of the CAs occur outside of the hospital setting.

Bystanders CPR, before arrival of expert help, contributes to better survival rates especially in cases of CA with a shockable rhythm (ventricular fibrillation and pulseless ventricular tachycardia)[10]. In those cases, rate of successful defibrillation increases, if CA victims receive bystander CPR[18,19]. Nowadays, bystanders CPR rates are low, even in modern societies and communities with well organized pre-hospital care systems[20].

In-hospital CA is not a sudden event but in most cases the result of a slow and progressive deterioration, which was either not recognized or not treated on time[13]. In-hospital CA rates vary widely across hospitals (1-5 CAs per 1000 admissions) and the outcome depends on parameters related to patient's medical history and reasons for hospital admission[21,22]. It has been documented by several literature studies that health care providers (physicians and nurses) are not capable to perform CPR successfully in cases of in-hospital CAs[23-26].

Scientific societies, working in the field of resuscitation (European Resuscitation Council in Europe), are aiming to establish a universal treatment algorithm for CA and a uniform ed-

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ucation and training system to teach CPR[13,20]. The International Liaison Committee on Resuscitation (ILCOR) is playing a fundamental role in the process leading to the publication of evidence based CPR guidelines.

According to the Greek law, training in CPR is mandatory for all health care providers (RF: 15576-219/22-2-2007).

The goal of education in CPR is to provide to the participants-especially health care providers-the appropriate knowledge and skills, so that they are adequately prepared to manage collapsed patients until advanced medical help arrives[13].

Resuscitation skills degrade to a significant degree after some months of training. Contributing factors to this are related to the participants, the instructors and training program[27-31]. It is of high importance to take into consideration, that CPR/AED skills might never be performed in daily clinical praxis and therefore frequent refresher and recertification courses could be very useful.

Moreover, the purpose of education is to result in a permanent behavior modification of health care providers, as far as CA management is concerned. Effectiveness of training courses is determined by many parameters, such as the total number of health care providers that participate in such courses, acquisition and retention of skills and mainly by improved outcomes after CA.

The aim of this study was to evaluate resuscitation skills and knowledge of the nursing staff of University Hospital "AHEPA" who participated in the validated training CPR/AED courses, held in our hospital.

MATERIAL AND METHODS

Sixty professionally active nurses-regardless of age, gender, level of education, previous work experience and hierarchical level-who had previously successfully completed a validated CPR/AED course were enrolled in this study. Participation in the study was voluntary. Reasons for recruiting nursing staff in this study included:

● to produce a homogenous sample

● nurses are the first responders to collapsed patients

● basic life support (BLS) is designed especially for first responders

Nursing staff is expected to recognize CA, to initiate CPR, to call for help, to activate the advanced life support (ALS) team or any other rapid response or medical emergency team (depending on the local protocol), to defibrillate (when indicated) with the use of AED and to continue resuscitation efforts until expert help arrives. Furthermore, nurses are responsible to check the emergency cart daily, to go through the check list and to maintain proper supplies of medical drugs and equipment[32,33].

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Resuscitation knowledge and skills of the participants were evaluated by:

● a questionnaire specifically designed for this study (Table 1)

Table 1: Questionnaire layout

Questions	
1. Gender	**10. Do you think that you still retain CPR knowledge and skills**
• Female	• Yes
• Male	• No
2. Age (years)	• To some extent
• 20- 30	**11. Have you ever performed CPR during your nursing shift**
• 31 – 40	• Yes
• 41-50	• No
• >50	**12. Which are the steps you have to follow in case of a CA in your working area**
3. Previous Working experience (years)	• Call for help – Initiate CPR – Bring AED
• 0-5	• Initiate CPR- Call for help- Bring AED
• 6-10	• Cal for help and wait until help arrives
• 11-20	
• >20	**13. Who are you calling for help in case of a CA**
4. Level of education	• Doctor on duty in my department
• University	• Anesthesiologist on duty
• Technological Education Institute	• Both of them
• Vocational Training Institute	• I do not know
5. Professional position	**14. Which is your hospital emergency number**
• Chief nursing officer	• Number
• Nurse Manager	• I do not remember
• Nurse Assistant Manager	• I do not know
• Nurse	• Wrong number
6. Department	**15. Is there a defibrillator in your working area**
• Internal medicine	• Manual
• Cardiology	• AED
• Intensive Care Unit	• Both
• Emergency Department	• There is not
• Outpatient Department	• I do not know
• Operation theatre	**16. Is there an emergency cart in your working area**
• Anesthesiology Department	• Yes
• Other	• No
7. How many times did you participate in a validated training CPR/AED course	• I do not known
• Once	**17. Would you perform CPR if it was indicated**
• Twice	• Yes
• More than twice	• No
• Never	• I do not known
8. The course was organized by	**18. Do you think the current CPR training program is effective**
• University Hospital AHEPA	• Yes
• National Centre of Emergency Care	• No
• Nursing School	• I do not know
• Other	**19. Would you like to participate again in such a validated CPR training course**
9. When did you participate in the course	• Yes
• 6 months ago	• No
• 6 months-1 year ago	**20. How often do you think one should repeat the CPR training course**
• 1 - 2 years ago	• Every year
• 2 – 3 years ago	• Every two years
• >3 years ago	• Other

● an assessment form for BLS/CPR and BLS with the use of AED, recommended by the European Resuscitation Council (ERC) (Table 2).

Table 2: CPR and AED evaluation form and participants success rates.

Skill	Candidate
CPR	
Ensure safety of rescuer, victim and bystanders	Demonstrates looking for potential dangers
Check response	Demonstrates gently shaking and shouting to establish responsiveness
Call for help	Demonstrates calling for help
Open airway	Demonstrates head tilt and chin lift
Assess breathing	Demonstrates looking, listening and feeling for normal breathing for no more than 10 sec whilst maintaining head tilt / chin lift
Get help	Describes how to phone for emergency services
Chest compressions	Demonstrates effective chest compressions (Rate 100-120, depth 5-6cm, Hand position – centre of the chest. Minimises interruption in chest compressions
Rescue breaths	Demonstrates rescue breaths sufficient to cause the chest to rise and fall
Compression: ventilation ratio	Demonstrates ratio of 30 compressions to 2 ventilations
Sequence	Demonstrates correct sequence
AED	
Assess victim	Demonstrates safe and effective initial assessment of collapsed victim according to CPR guidelines
Activate AED	Demonstrates switching AED on
Attach pads	Demonstrates attaching pads in acceptable position
Stand clear	Allows rhythm analysis whilst making sure that nobody touches the victim (including visual sweep and verbal instruction)
Deliver shock	Demonstrates rapid and safe delivery of a shock (including visual sweep and verbal instruction to stand clear)
Follow AED instructions	Demonstrates listening to and executing AED instructions
CPR	Minimises interruption to chest compressions

The study protocol was reviewed and approved by the hospital scientific and ethics

committee and a study permit document number was obtained.

Participation in the study was optional and the questionnaire was anonymous. In order to protect anonymity, no consent was obtained by the participants of the study. However, completion of the questionnaire was considered as consenting to be enrolled in the study.

The questionnaire consisted of 20 questions: 10 on demographic data, 5 about attitude during CA and the last 5 about participants' opinion on the resuscitation training they received.

Initially, participants filled out the questionnaire and thereafter they were expected to respond to a simulated CA scenario of a collapsed patient in an area, where AED was available.

Data were recorded in predesigned forms and thereafter they were transferred in preformatted EXCEL worksheets. SPSS 21 was used for the statistical analysis (IBM SPSS statistics 21).

Data recorded, were presented in frequency and percentage tables, as suggested by SPSS for quality parameters. Chi square test was used to evaluate correlation between independent (questions 1 to 9) and dependent (questions 10 to 20) variables and moreover CPR/AED skills. Statistical significance was set at a p value less than 0.05.

RESULTS

According to the study protocol all of the participants were professionally active nurses. The vast majority of the study population were women (83.3%), 41-50 years old (70%) with more than 21years working experience (53.3%) and they had graduated from a Technological Educational Institute (58,3%). Demographic data are presented in detail in table 3.

Table 3: Patient's demographic data

DEMOGRAPHIC DATA	Frequency	Percentage (%)
Gender		
• Female	50	83,3
• Male	10	16,7
Age (years)		
• 20- 30	1	1,7
• 31 – 40	15	25
• 41-50	42	70
• >50	32	3,3
3. Previous Working experience (years)		
• 0-5	2	3,3
• 6-10	14	23,3
• 11-20	12	20
• >20	32	53,3
4. Level of education		
• University	2	3,3
• Technological Education Institute	35	58,3
• Vocational Training Institute	23	38,3
5. Professional position		
• Chief nursing officer	0	0
• Nurse Manager	3	5
• Nurse Assistant Manager	5	8,2
• Nurse	52	86,7
6. Department		
• Internal medicine	6	10
• Cardiology	4	6,7
• Intensive Care Unit	8	13,3
• Emergency Department	7	11,7
• Outpatient Department	12	20
• Operation theatre	9	15
• Anesthesiology Department	2	3,3
• Other	12	20

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Study participants have previously successfully completed a validated CPR/AED ERC course held in AHEPA University hospital as part of their educational program in resuscitation. More than half of them have participated more than once in such a course (43.3% twice and 15% more than twice). Time elapsed since completion of the CPR/AED course was more than 3 years for 48.3%, 2-3 years for 15% and 1-2 years for 23% of the study participants. The rest of the frequency and percentage values related to resuscitation training are presented in table 4.

In case of an in-hospital CA, almost all of the participants responded that they would call immediately for help and then they would initiate CPR. Generally, they tend to call both the doctor on duty in their department and the anesthesiologist on duty. 30% of the participants did not remember the hospital emergency number or they remembered the wrong phone number.

58,3% of the study participants think that they still retain resuscitation skills and knowledge. All of them stated that they would be willing to initiate CPR efforts, although only 43% of the nurses have actually performed CPR during their nursing shift.

CPR performance and AED use in the simulated scenarios were evaluated as adequate in more than 50% and more than 60% respectively (table 4).

Table 4: Frequency and percentage values related to resuscitation training of the study.

How many times did you participate in a validated training CPR/AED course	Frequency	Percentage (%)
• Once	25	41,7
• Twice	26	43,3
• More than twice	9	15
• Never	0	0
The course was organized by		
• University Hospital AHEPA	58	96,7
• National Centre of Emergency Care	1	1,7
• Nursing School	0	0
• Other	1	1,7
When did you participate in the course		
• 6 months ago	6	10
• 6 months-1 year ago	2	3,3
• 1 - 2 years ago	14	23,3
• 2 – 3 years ago	9	15
• >3 years ago	29	48,3
Do you think that you still retain CPR knowledge and skills		
• Yes	35	58,3
• No	0	0
• To some extent	25	41,7
Have you ever performed CPR during your nursing shift		
• Yes	26	43,3
• No	34	56,7
Which are the steps you have to follow in case of a CA in your working area		
• Call for help – Initiate CPR – Bring AED	42	70
• Initiate CPR- Call for help- Bring AED	17	28,3
• Cal for help and wait until help arrives	1	1,7
Who are you calling for help in case of a CA		
• Doctor on duty in my department	6	10
• Anesthesiologist on duty	22	36,7
• Both of them	32	53,3
• I do not know	0	0
Which is your hospital emergency number		
• Number	42	70
• I do not remember	8	13,3
• I do not know	1	1,7
• Wrong number	9	15
Is there a defibrillator in your working area		
• Manual	30	50
• AED	21	35
• Both	7	11,7
• There is not	2	3,3
• I do not know	0	0
Is there an emergency cart in your working area		
• Yes	59	98,3
• No	1	1,7
• I do not known	0	0
Would you perform CPR if it was indicated		
• Yes	59	98,3
• No	0	0
• I do not known	1	1,7
Do you think the current CPR training program is effective		
• Yes	59	98,3
• No	0	0
• I do not know	1,7	1,7
Would you like to participate again in such a validated CPR training course		
• Yes	55	91,7
• No	5	8,3
How often do you think one should repeat the CPR training course		
• Every year	26	43,3
• Every two years	30	50
• Other	4	6,7

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25% (15 out of 60) of the participants performed successfully all 10 skills related to CPR, whereas 6.6% (4 out of 60) did not achieve any skill. As far as the use of AED is concerned the corresponding percentages were 41.7% (25 out of 60) and 1.7% (1 out of 60) and in total (both CPR performance and AED use) 18.3% and 1.7% respectively (table 5).

Table 5: CPR and AED skills success rates of participants.

CPR		
n	Frequency	Percent
0	4	6,7
1	4	6,7
2	5	8,3
3	1	1,7
4	3	5,0
5	4	6,7
6	6	10,0
7	2	3,3
8	8	13,3
9	8	13,3
10	15	25,0
AED		
0	1	1,7
1	2	3,3
2	5	8,3
3	5	8,3
4	5	8,3
5	6	10,0
6	11	18,3
7	25	41,7

Data correlation revealed that nurses with a working experience of 6-10years and those working in the ED or in the ICU have performed CPR during their working shift far more often compared to the rest of the nursing staff.

Furthermore, much more nurses compared to nurse managers and assistant managers, consider that their resuscitation training program is effective and women want to be recertified in a higher rate than men.

Managers and assistant managers were more successful than nurses in performance of "Check response", "Breathing efforts" and "AED activation" skills.

"Stand clear" skill was performed more frequently by participants over 50 years of age and shock was delivered more often by nurses working in the ICU or in the ED.

DISCUSSION

Training in resuscitation is one of the most important factors influencing outcome after CA[1,20,34]. Since the 1960s, when modern CPR was formally endorsed[35,36], training in resuscitation for health care professionals and public has gained increasing attention[1,20] . Therefore, the International Committee on Resuscitation (ILCOR) has already published recommendations related to education and training in CPR[14,28]. Moreover, one of the ERC working groups are responsible for establishing guidelines for education and one chapter in the latest ERC CPR guidelines is about principles of education in resuscitation.[13]

Today, it is well known and documented, that CPR performed by bystanders can improve outcome after CA[39-41]. In addition to this, in-hospital CA is not usually a sudden unpredictable event but the result of a slow and progressive deterioration[13,43]. Therefore, early recognition of the deteriorating patient and prevention of CA are key elements in the chain of survival[13,37,44].

After completion of a questionnaire, specifically designed for this study, participants were expected to respond to a simulated CA scenario of a collapsed patient in an area, where AED was available. Manikins and AED devices were similar to the ones used in the validated CPR/AED courses.

Demographic data analysis revealed that the vast majority of the study population was women (83.3%), which was an expected result, since most of the nurses working in the University Hospital "AHEPA" are women.

Almost all of the participants were between 30-50years old (31-40years 25% and 41-50years 70%). This result is attributed to several premature retirements (due to the new pension measures) and to "hiring freeze" (due to the financial crisis and the memorandum). This also explains the fact that most of the nurses (53.3%) have been working for more than 20years.

Most of the participants have graduated from a Technological Educational Institute (58.5%), whereas 38.3% have graduated from a Vocational Training Institute and very few have graduated from University. These percentages reflect the academic degrees of the professionally active nurses working in the University Hospital "AHEPA".

According to the available data, nurses were the vast majority of the participants included in our study (86.5%) as opposed to nurse manag-

ers and assistant managers. Nurse predominance reflects clinical reality since standard nursing staff consists of many nurses and only a few managers and assistant managers.

The smashing majority of the nursing staff included in our study (96.7%) has participated in validated BLS/AED courses held in our hospital and most of them more than once. Contributing factors to broad acceptance of our hospital's training program are its longevity in conjunction with the fact that education is offered with no participation fee (as opposed to what is common practice in our city) during working hours (both for the participants and the instructors). Time elapsed since completion of the CPR/AED course was more than 1year for the vast majority of the participants and more than 3years for half of them[45]. According to ERC Course Rules, certified BLS/AED providers are responsible to recertify within 6 months before expiration of their certificate by completing successfully either a full BLS/AED provider course or the corresponding recertification course[46,47].

Nursing staff knows beyond any doubt that in case of a CA they should call immediately for help and initiate CPR. A manual or automated defibrillator is available in every department of our hospital; in some cases even both are available.

53.3% of the nursing staff calls both the physician on duty in their department and the anes-

thesiologist on duty, whereas only 10% calls just the physician on duty. This reflects the common belief that may actually be a fact that doctors of other specialties are not competent in performing resuscitation. Lack of specific medical emergency teams may cause confusion about whom to call in case of CA. The fact that a significant percentage of the nursing staff did not remember the emergency phone number or remembered the wrong phone number underlines the necessity of a better organization of emergency call centers and communications.

Despite the fact that more than half of the study participants (56.7%) have never performed CPR during their nursing shift, almost all of them (96.7%) stated that they would be willing to initiate CPR in the future, if this would be indicated[48]. A significant percentage of the nursing staff (58.3%) thinks that they still retain resuscitation skills and knowledge, although many of them have never performed those skills. This data indicates that there is a high possibility that CPR/AED skills will be never performed even by health care providers. Almost all of the nurses (98.3%) think that resuscitation training via validated ERC courses is very effective and they would like to re-participate in such a course. Half of them believe that resuscitation training should be repeated every year and the other half every 2 years[46,47,49].

CPR performance in the simulated scenarios was evaluated as adequate in more than 50%. The highest achievement score was recorded for "check response" skill (85%) and the lowest for "open the airway" skill (48.3%). This difference in achievement scores reflects clinical reality since skills such as "check response" and "call for help" are performed in many other clinical settings besides CA, whereas skills like "open airway" and "assess breathing" are considered to be an anesthesiologist's responsibility.

As far as the use of AED is concerned, the overall success rates were in general better, and almost 100% of the participants have activated the AED successfully. These findings are in accordance with other studies, where is has been shown that skills related to the use of AED can be retained for a longer period of time. It seems that the easy usage of the AED device in conjunction with the understanding of its significance contribute to the longer retention of the specific skills.

Data analysis revealed that only a small percentage of the participants failed to perform any skill and almost 1/3 of the participants performed successfully less than half of the skills (CPR or AED skills in total).

These findings confirm other literature study results concerning loss of skills over time and indicate the necessity of re-training courses for skills and knowledge retention.

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As expected, nurses working in the ED or in the ICU, where CAs actually happen more often, have performed CPR more frequently and were more successful in shock delivery compared to the rest of the nursing staff working in other departments.

Observance of safety rules related to AED use was better among nurses over 51years of age and worse in nurses between 20-30years old. This result reflects the enthusiasm of the younger people and the experience of the elder.

A possible limitation of the study is the relatively small number of study participants compared to the total number of BLS/AED providers and the total number of people working in the University Hospital "AHEPA", which does not allow generalization of the study results. Moreover, due to the small number of managers and assistant managers included in our study, we cannot draw any safe conclusions from the correlation analysis of the study parameters with the professional position of the nurses.

CONCLUSION

The findings of this study suggest that resuscitation skills degrade after training to a significant extend. There was no correlation between skill loss and parameters such as age, number or previous BLS/AED courses or time elapsed since training. Overall, participants showed a

better retention of AED skills compared to CPR skills. Also, frequent refresher and recertification courses could be useful and promoting simulation training in resuscitation (simulated CA scenarios), could attribute to substantial modification of nurses behavior in case of a real CA.

REFERENCES

1. Taniguchi D, Baernstein A, Nichol G. Cardiac arrest: A public health perspective. Emerg Med Clin N Am 2012;30:13–23.

2. Rea T, Eisenberg M, Sinibaldi G, et al. Incidence of EMS-treated out-of-hospital cardiac arrest in the United States. Resuscitation 2004 Oct;63:17-24

3. Berdowski J, Berg R, Tijssen J, et al. Global incidences of out-of-hospital cardiac arrest and survival rates: systematic review of 67 prospective studies. Resuscitation, 2010;81:1479-87.

4. Atwood C, Eisenberg M, Herlitz J, et al. Incidence of EMS-treated out of hospital cardiac arrest in Europe. Resuscitation 2005; 67:75-80.

5. Georgiou M, Lockey A. ERC initiatives to reduce the burden of cardiac arrest: The European Cardiac Arrest Awareness Day. Best Practice & Research Clinical Anaesthesiology 2013;27: 307-15.

6. Go S, Mozaffarian D, Roger V, et al. Heart disease and stroke statistics -2013 update: a report from the American Heart Association. Circulatio 2001;127:6-245.

7. Loyd-Jones D, Adams R, Brown T, et al. Heart disease and stroke statistics 2010 update: a report from the American Heart Association. Circulation 2010; 121:46 -215.

8. Sans S, Kesteloot H, Kromhout D. The burden of cardiovascular diseases Mortality in Europe" Task Force of the European Society of Cardiology on Cardiovascular Mortality and Morbidity Statistics in Europe. Eur Heart J 1997;18:1231-48.

9. Gräsner, J. Bossaert, L. Epidemiology and management of cardiac arrest: What registries are revealing. Best Practice & Research Clinical Anaesthesiology 2013;27:293-306.

10. Chamberlain D, Cummins R, Abramson N, et al. Recommended guidelines for uniform reporting of data from out-ofhospital cardiac arrest: the 'Utstein style': prepared by a task force of representatives from the European Resuscitation Council, American Heart Association, Heart and Stroke Foundation of Canada, Australian Resuscitation Council. Resuscitation 1991;22:1–26.

11. Cummins R, Chamberlain D, Hazinski MF, et al. Recommended guidelines for reviewing, reporting and conducting research on in-hospital resuscitation, the "in-hospital Utstein style". Resuscitation 1997;34:151–83.

12. Jacobs I, Nadkarni V, Bahr J, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries. A statement for healthcare professionals from a task force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian Resuscitation Council, New Zealand Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Southern Africa). Resuscitation 2004;63:233–49.

13. Nolan J, Soar J, Zideman D, et al. European Resuscitation Council Guidelines for Resuscitation 2010 Section Executive summary. Resuscitation 2010;81: 1210-76.

14. Nolan, J. International CPR guidelines-Perspectives in CPR. Best Practice & Research. Clin Anesthesiol 2013;27:317-25.

15. Koster R, Michael A. Baubin M, Leo L. Bossaert L et al. European Resuscitation Council Guidelines for Resuscitation 2010 Section 2. Adult basic life support and use

of automated external defibrillators. Resuscitation 2010;81:1277-92.

16. Cummins R, Ornato J, Thies W et al. Improving survival from sudden cardiac arrest: the ''chain of survival'' concept. A statement for health professionals from the Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee, American Heart Association. Circulation 1991;83: 1832-47.

17. Soreide E, Morrison L, Hillman K. The formula for survival in resuscitation Collaborators. Resuscitation 2013; 84: 1487-93.

18. Holmberg M, Holmberg S, Herlitz J. Effect of bystander cardiopulmonary resuscitation in out-of-hospital cardiac arrest patients in Sweden. Resuscitation 2000;47:59-70.

19. Sedgwick M, Dalziel K, Watson J, et al Performance of an established system of first responder out-of-hospital defibrillation: the results of the second year of the Heart start Scotland Project in the Utstein Style. Resuscitation 1993; 26:75-88.

20. Baskett P, Nolan J, Handley A, et al. European Resuscitation Council Guidelines for Resuscitation 2005 Section 9. Principles of training in resuscitation. Resuscitation 2005;67:181-9.

21. Larkin G, Copes W, Nathanson B et al. Pre-resuscitation factors associated with mortality in 49,130 cases of in-hospital cardiac arrest: a report from the National Registry for Cardiopulmonary Resuscitation. Resuscitation. 2010;81:302–11.

22. Mc Mullan P, Vanden Hoek T, Halverson C, et al. Strategies for improving survival after in-hospital cardiac arrest in the United States: 2013 consensus recommendations A Consensus Statement. From the American Heart Association. Circulation. 2013;127:1538-63.

23. Brenner B, Van D, Cheng D, et al. Determinants of reluctance to perform CPR among residents and applicants: the impact of experience on helping behaviour. Resuscitation 1997;35:203 -11.

24. Goucke C, Dobb G. Cardiopulmonary resuscitation skills of hospital medical and nursing staff members. Med J Aust 1986;145:496-7.

25. Nyman J, Sihvonen M. Cardiopulmonary resuscitation skills in nurses and nursing students. Resuscitation 2000;47:179 - 84.

26. Ragavan S, Schneider H, Kloeck W. Basic resuscitation / knowledge and skills of full-time medical practitioners at public hospitals in northern province. S Afr Med J 2000;90:504 -/8.

27. Chamberlain D, Hazinski M. Education in resuscitation. Resuscitation 2003; 59:11-43.

28. Chamberlain D, Hazinski M. ILCOR Advisory Statement Education in Resuscitation. Resuscitation 2003; 59:11-43.

29. Amith G. Revising educational requirements: challenging four hours for both basic life support and automated external defibrillators. New Horiz 1997;5:167-72.

30. Chamberlain D, Smith A, Woollard M, et al. Trials of teaching methods in basic life support: comparison of simulated CPR performance after first training and at 6 months, with a note on the value of re-training". Resuscitation 2002;53:179-87.

31. Handley J, Handley A. Four-step CPR /improving skill retention. Resuscitation 1998; 36: 3-8.

32. Clements A, Curtis K. What is the impact of nursing roles in hospital patient resuscitation" Australasian Emergency Nursing Journal 2012;15:108-115.

33. Preusch M, Beaa F, Roggenbach J, et al. Resuscitation Guidelines 2005: does experienced nursing staff need training and how effective is it. American Journal of Emergency Medicine 2010;28:477-84.

34. Eldar S, Morrison L, Hillman K, et al. The formula for survival in resuscitation. Resuscitation 2013;84:1487-93.

35. Safar P. History of cardiopulmonary-cerebral resuscitation. Clinics in Critical Care Medicine 1989;16: 1-53.

36. Safar P. History of modern resuscitation. Critical Care Medicine 1996;24:3-11.

37. Cummins R, Chamberlain D. Advisory statements of the International Liaison Committee on Resuscitation. Circulation 1997;95:2172-2210.

38. Eisenberg M, Baskett P, Chamberlain D. A history of cardiopulmonary resuscitation in Paradis N, Halperin H, Kern K, Wenzel V, Chamberlain D (eds). Cardiac Arrest, the science and practice of resuscitation medicine, Cambridge University Press 2007 New York, 3-25.

39. Bossaert L, Van Hoeyweghen R. the Cerebral Resuscitation Study Group. Bystander cardiopulmonary resuscitation (CPR) in out-of hospital cardiac arrest. Resuscitation 1989;17:199 - 206.

40. Christenson J, Nafziger S, Compton S, et al. The effect of time on CPR and automated external defibrillator skills in the public access defibrillation trial". Resuscitation 2007;74:52-62.

41. Cummins R, Eisenberg M, Hallstrom, et al. A Survival of out-of-hospital cardiac arrest with early initiation of cardiopulmonary resuscitation. Am J Emerg Med 1985;3:114-9.

42. Ritter, G, Wolfe R., Goldstein S, et al. The effect of bystander CPR on survival of out-of-hospital cardiac arrest victims. Am Heart J 1985;110:932-7.

43. Charles D. Deakin Ch, Nolan J, et al. European Resuscitation Council Guidelines for Resuscitation 2010 Section 4. Adult advanced life support. Resuscitation 2010;81:1305-51.

44. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Guidelines for cardiopulmonary resuscitation and emergency cardiac care, I: introduction. JAMA 1992;268:2171-83.

45. Smith K, Gilcreast D, Pierce K. Evaluation of staff's retention of ACLS and BLS skills. Resuscitation 2008;78:59-65.

46. European Resuscitation Council. ERC Course rules. www.erc.edu (assessed 3/12/2014)

47. Woollard M, Whitfield R, Newcombe R, et al. Optimal refresher training intervals for AED and CPR skills: a randomised controlled trial. Resuscitation 2006;71:237-47.

48. Swor R, Khan I, Domeier A, et al. CPR training and CPR performance: Do CPR-trained bystanders perform CPR. Acad Emerg Med 2006;13:596-601.

49. Berden H, Willems F, Hendrick J, et al. How frequently should basic cardiopulmonary resuscitation training be repeated to maintain adequate skills. BMJ 1993;306:1576-7.

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